

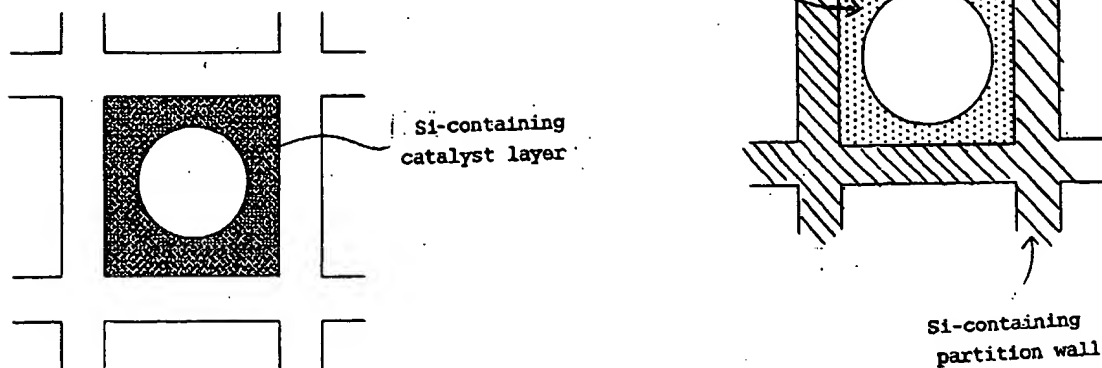
REMARKS

Claims 1-6 and 8, as amended, remain herein.

1. Applicants thank the Examiner for the courteous interview granted their attorney on February 11, 2004. The substance of the arguments presented at the interview appears below.

2. Claims 1, 2, and 5-8 were rejected under 35 USC 102(b) as anticipated by WO 97/47864. Claim 1 is amended, claim 7 is canceled and the rejection is traversed, if applied to the remaining amended claims. (The cited publication has a U.S. counterpart, which is Patent No. 6,161,378.)

At the interview a sketch titled Exhibit A was presented to the Examiner and a copy is enclosed with the reply. Two of the figures from Exhibit A appear below:



C. Si-containing catalyst layer

Present Invention

On the left is Fig. C depicting a Si-containing catalyst layer coated on the partition wall as in the Prior Art. Silica is in the washcoat coating and not in the partition walls. The right drawing depicts the Present Invention where Si is contained in the partition walls in a controlled amount to prevent deterioration of the partition walls of the honeycomb carrier during use.

To emphasize this above-mentioned feature of the invention, claim 1 has been amended to incorporate the honeycomb embodiment of claim 7 with a further description of the carrier as a honeycomb carrier having conventional thin partition walls and through-holes as described in paragraph [0014] on page 6, lines 23-25. Claim 1 is amended further to specify that the carrier containing the silica is in the partition walls and contains an amount of Si "sufficient to prevent deterioration of the honeycomb

carrier." Basis for this description can be found in the original claim and paragraph [0008] bridging pages 3 and 4 where the expression "the content of Si in the carrier-composing material" appears. Because this carrier-composing material is the material that makes up the partition walls in the honeycomb embodiment, Si is clearly in the partition walls. Finally, the phrase "to prevent deterioration of the honeycomb carrier" is further supported in paragraph [0004] on page 2, line 14; the recited function is completely novel. As discussed below, the cited prior art has Si only as a washcoat ingredient of a NOx catalyst that is coated on the partition walls.

At the interview the Examiner said that a "new issue" might be raised by the indicated amendment to claim 1. Applicants say no new issue has been raised because original claim 7 is directed to an embodiment where the carrier is a "honeycomb carrier." It is well known that these honeycombs are made of thin partition walls which define through-holes for the exhaust gas to pass.

WO 97/47864 discloses a NOx catalyst for exhaust gases. The reference at page 19, third full paragraph (cited by the Examiner), reads:

To the porous support of 100 wt%, it is preferable to include the rare earth metals of 5-30 wt %. To the porous support of 100 wt%, it is preferable to include Ti of 0.1-30 wt %, and to the porous support of 100 wt%, it is preferable to include Si of 0.6-5 wt % as silica.

There is no disclosure here why one is adding silica. However, the reference at page 66, lines 5-13 states:

In Embodiment Catalyst 100, in case where SiO<sub>2</sub> supported amount was varied the NO<sub>x</sub> gas purification rate was measured. The catalyst preparation manner and the experimental manner were similarly [sic] to those of Embodiment Catalyst 100. The results are shown in Table 11. By supporting SiO<sub>2</sub>, the initial period NO<sub>x</sub> gas purification rate is improved. Further, the support amount of SiO<sub>2</sub>, was 0.6 wt% - 5 wt%, NO<sub>x</sub> gas purification rate after SO<sub>2</sub> poisoning can obtain 60%.

Silica thus has been added in the prior art invention to improve the initial period NO<sub>x</sub> gas purification rate. Embodiment 100 catalyst manufacture is described on page 63; the catalyst support is cordierite. Table 9 (page 64) shows that for the Embodiment 100 catalyst, the first component added to the alumina washcoat is Ce, after which Sr and SiO<sub>2</sub> are added. This treatment is followed by adding both Rh and Pt and then finally Mg. Thus, the silica of the Embodiment 100 catalyst is in the alumina washcoat added as a coating to the pre-existing cordierite support.

The present invention, in contrast to the cited art, involves increasing the strength of the NO<sub>x</sub> catalyst at high temperature.

See the specification at page 3, lines 15-29 reading:

In general, carrier-composing materials decrease their strengths when they are exposed to high temperatures together with an alkali metal-containing catalyst layer. However, when they contain a small amount of Si therein, their initial strength can be increased and, as a result, they can possess a strength necessary for catalyst carrier even if their strength is slightly decreased, for example, when they are exposed to high temperatures with an alkali-containing catalyst layer. Such an effect brought about by the inclusion of Si is striking in catalyst-composing ceramic materials, particularly in ceramic materials wherein the particles of the major component contain no Si therein and the bonding between the particles is relatively weak, such as alumina, aluminum titanate and the like. It is because Si bond the particles at the boundaries or assists such bonding.

Applicants' silica as discussed above is added to the material that forms the carrier. The silica provides increased strength to the carrier support. WO 97/47864 has no teaching or suggestion of adding Si to a carrier before forming the carrier structure.

Accordingly, review and withdrawal of this rejection are requested.

3. Claims 1-5 were rejected under 35 USC 102(b) as anticipated by Freudenberg et al. '153. This rejection is traversed.

Freudenberg et al. '153 discloses sintered ceramic materials based on aluminum titanate where  $\text{SiO}_2$  and  $\text{MgO}$  are added in the slip casting process. Although it is stated at col. 5, line 45, that the ceramic composition can be used as a catalyst support, no examples are provided of any catalysts or the catalytic metals employed. Furthermore, the reference contains no discussion of  $\text{NO}_x$  catalysts and a problem arising at higher temperatures caused by reaction of the alkali metal with the carrier. Although Freudenberg et al. '153 discusses in col. 3, lines 55-64, the addition of  $\text{SiO}_2$  improves physical properties, the reference contains no suggestion that  $\text{SiO}_2$  would help solve the problem of carrier deterioration by  $\text{NO}_x$  alkali metals.

Table IV (4) of the patent shows various amounts of  $\text{SiO}_2$ ; the table is described in col. 8, lines 25-37, where it is noted that  $\text{SiO}_2$  is important to stability under oxidizing conditions and  $\text{MgO}$  is important to stability under reducing conditions. There is no recognition of any ability of  $\text{SiO}_2$  to prevent deterioration of a honeycomb carrier of a  $\text{NO}_x$  catalyst where alkali metals are present.

In the rejection of claim 5, the Examiner notes  $\text{MgO}$  is disclosed in the reference, citing the Abstract. However, as discussed already,  $\text{MgO}$  is needed to provide stability under reducing conditions. There is no recognition in the reference of

combining MgO and SiO<sub>2</sub> to be able to improve the strength of a honeycomb carrier of a NO<sub>x</sub> catalyst where alkali metals are present.

Accordingly, review and withdrawal of this rejection are requested.

4. Claims 1, 2, and 4-8 were rejected under 35 USC 102(e) as anticipated by Hori et al. '081. This rejection is traversed.

Hori et al. '081 discloses a catalyst for use with a lean burn engine. The catalyst contains an alkali metal (see col. 5, lines 36 et seq.) for adsorbing the oxidized and activated NO<sub>x</sub>, particularly NO<sub>2</sub>. The addition of silicon oxides is discussed at col. 3, lines 37-53 thusly:

i) The refractory inorganic oxide to be used for carrying platinum partly or wholly thereon may be any of the refractory inorganic oxides which are generally adopted as the carrier for a catalyst with the exception of cerium oxide. As concrete examples of such refractory inorganic oxides, there may be cited, for example,  $\alpha$ -alumina,  $\gamma$ ,  $\delta$ ,  $\zeta$ , and  $\epsilon$  active alumina, titania, or zirconia; silicon oxide, and complex oxides thereof such as, alumina-titania, alumina-zirconia, titania-zirconia etc. The oxides and complex oxides of aluminum, zirconium, titanium, and silicon, mixtures thereof, are preferably used and active alumina is used especially. When platinum is carried partly on the refractory inorganic oxide, the weight of the refractory inorganic oxide not containing platinum may be up to 20% by weight based on the weight of the refractory inorganic oxide containing platinum.

The silicon oxide is in the reference catalyst layer as a support for Pt. Hori et al. '081 provides no awareness of any ability of  $\text{SiO}_2$  to prevent deterioration of a honeycomb carrier of a  $\text{NO}_x$  catalyst where alkali metals are present.

The Examiner cites Example 4 where 5% silica is shown. However, Example 7 contains a very large amount of silicon oxide (100 g), which appears to function as a replacement for the active alumina in Example 4. Given the use of these different amounts of silicon oxide, Hori et al. '081 does not suggest to the artisan selecting only a low amount of silicon oxide (as presently claimed) to avoid the deterioration of the carrier in a  $\text{NO}_x$  catalyst by alkali metal. Furthermore, the silicon oxide in the reference is a part of the catalyst layer that is coated on the carrier. See Example 1 where the catalyst coating is applied to a commercially-available cordierite honeycomb substrate (i.e., the carrier). The silicon oxide is not contained in the carrier-forming materials used to make the honeycomb carrier.

Accordingly, review and withdrawal of this rejection are requested.

Applicants respectfully submit that the present application is now in condition for allowance. Accordingly, the Examiner is requested to issue a Notice of Allowance for all pending claims.



Serial No. 09/845,317

Should the Examiner deem that any further action by the applicants would be desirable for placing this application in even better condition for issue, the Examiner is requested to telephone applicants= undersigned representative at the number listed below.

Respectfully submitted,

PARKHURST & WENDEL, L.L.P.



Charles A. Wendel  
Registration No. 24,453

February 19, 2004  
Date

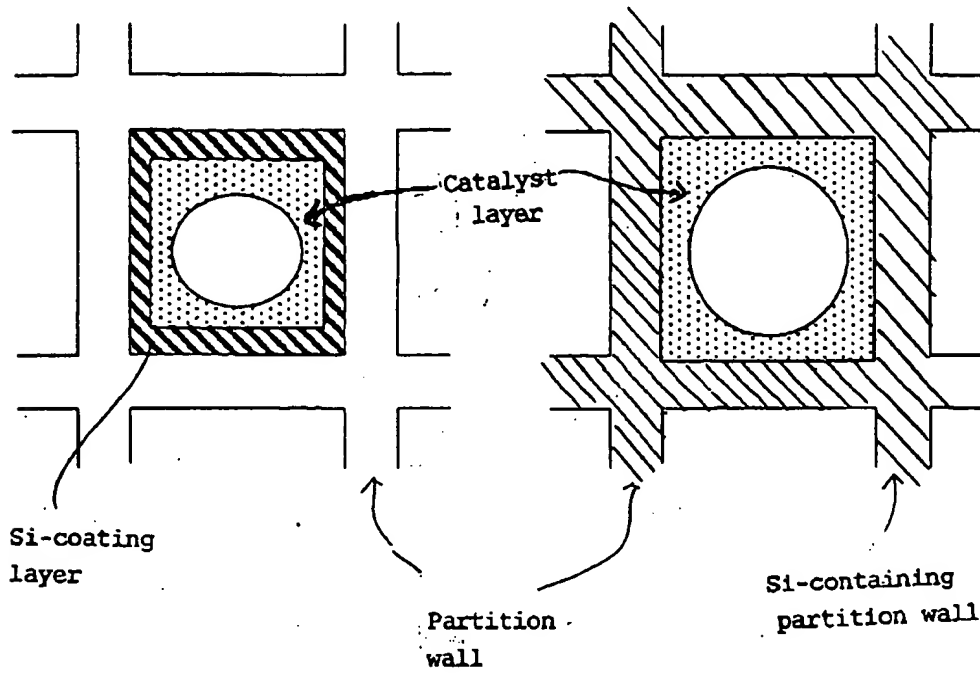
Enclosure: Exhibit A

CAW:EC/klb  
Attorney Docket No. WATK:212  
PARKHURST & WENDEL, L.L.P.  
1421 Prince Street, Suite 210  
Alexandria, Virginia 22314-2805  
Telephone: (703) 739-0220



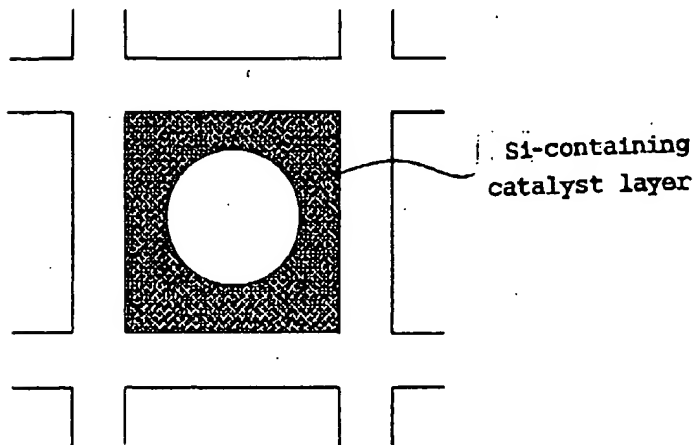
EXHIBIT A

Structural Difference



A. Si-Coating layer +  
Catalyst layer

Present Invention



C. Si-containing catalyst layer